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Journal of Banking & Finance 30 (2006) 3453–3468
Journal of BANKING & FINANCE
www.elsevier.com/locate/jbf

Earnings management at rights issues thresholds—Evidence from China ☆

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Received 22 April 2004; accepted 10 January 2006
Available online 27 July 2006

Abstract

Burgstahler and Dichev (BD) (Burgstahler, David, Ilia, Dichev, 1997. Earnings management to avoid earnings decreases and losses. Journal of Accounting and Economics 23(1), 99–126.) and Degorge, Patel, and Zeckhauser (DPZ) (Degeorge, Franscois, Patel, Jayendu, Zeckhauser, Richard, 1999. Earnings management to exceed thresholds. Journal of Business 72(1), 1–33.) examine earnings management among American firms by looking at actual distributions around critical thresholds. Chinese firms must meet minimal ROE requirements if they are to have rights issues. Using a distribution approach, we examine whether Chinese firms manipulate their earnings to meet the regulatory requirements. Our empirical findings indicate that Chinese firms indeed heavily engaged in earnings management to meet the rights issue thresholds during the period 1994–2002. In addition, we show that these firms changed their behavior in response to changes in regulatory requirements. Furthermore, we analyse the pervasiveness of this practice and the means used in earnings management at the relevant ROE thresholds. Our findings have direct policy implications for the China Securities Regulatory Committee (CSRC).

☆ This research has been supported by two grants from Xiamen University and Nanyang Business School, respectively. The authors would like to thank Yuxing Yan, Wilson Tong, Martin Young, Shaojun Zhang, Yujun Wu, two anonymous referees and the journal editor, seminar participants at Nanyang Technological University, Massey University, Xiamen University, and attendees at the 2004 FMA Asian Meeting for helpful comments and suggestions.
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doi:10.1016/j.jbankfin.2006.01.011

JEL classification: G39

Keywords: Earnings management; Earnings thresholds; Rights issues; Distribution approach

1. Introduction

Despite the perception that earnings management or earnings fabrication is a widespread practice among China's listed firms, not many empirical studies have been undertaken to detect this practice and its pervasiveness in China.[3] As an exception, Chen and Yuan (2004) examine earnings management by China's listed firms to meet the regulatory requirement on return on equity (ROE) for rights issues. Using the industry-adjusted non-operating income, these authors find that Chinese firms engaged in earnings management to meet the minimum 10% ROE required for rights issues during the period 1996–1998. They also find that such earnings management in anticipation of rights issues has a negative impact on the subsequent performance of the firms.

Unlike their study which covers a three-year period, we use a distribution approach to examine the earnings management at two ROE thresholds that Chinese firms had to exceed before they were allowed to raise new equity capital through rights issues for a much longer period, 1994–2002. The distribution approach used is intuitive and direct. It does not require the estimates on abnormal accounting accruals which are inevitably noisy. Previous studies use the distribution approach mainly to deal with situations where particular levels, such as zero earnings or zero earnings growth, are prominent, based on the prospect theory. However, a regulatory standard is exogenously determined and is more susceptible to management since earnings targets have to be met or exceeded.

The Chinese dataset is particularly suitable for a study using the distribution approach. As mentioned earlier, the ROE threshold required for rights issues in China is exogenously determined. In addition, the Chinese dataset allows us to detect the dynamic nature of earnings management in response to regulatory changes. During the 1994–2002 period, the rights issues threshold changed twice. In fact, to the best of our knowledge, this is the first study using a distribution approach to examine earnings management in response to regulatory changes.

Our study is of interest because China is the largest developing economy with a fast-growing stock market which attracts the attention of researchers and potential investors all over the world. For example, the ratio of China's stock market capitalization to GDP increased from 4% in 1992 to about 60% in 2002, and the investment accounts increased from under 5 million to over 60 million during the same period. At the end of 2002, there were about 1200 firms listed on China's two national stock exchanges, the

[3] There have been numerous scandals concerning manipulation of financial statements. For example, Hainan Minyuan Modern Agricultural Development manipulated its 1996 financial report and boosted its net profit by RMB540 million (see *China Securities Daily*, April 29, 2001). Hongguang, a Chengdu-based company, was found guilty of manipulating its financial report in 1996 to get listed on the Shanghai Stock Exchange, (see www.stock2000.com.cn). More recent cases include Yinguangxia, Zhengzhou Baiwen, KMK, Yorkpoint S&T Co. etc. (see *People's Daily*, December 23, 2001). A commentary in the *China Securities Daily* (October 5, 2001) pointed out that earnings management and fabrication are so pervasive that they have shaken investor confidence in China's stock market.

Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE), which were only established in 1990 and 1991, respectively. Now the trading volume in the Chinese stock market is second only to Japan in Asia.

Using the distribution approach developed by BD (1997) and DPZ (1999), we find the following. First, earnings management exists at ROE thresholds, namely, at 10% for the period 1994–1998, 10% and 6% for the period 1999–2000, and 6% for the period 2001–2002. Second, earnings management responds to changes in regulation. Third, earnings management around the regulatory thresholds is very pervasive. Finally, the non-core income[4] appears to be an important means for earnings management in China. These findings are consistent with Chen and Yuan (2004) in that Chinese-listed firms engage in earnings management in order to raise new equity in the market. These findings also have policy implications for the China Securities Regulatory Committee (CSRC), the government watchdog in securities markets. To restore investor confidence, CSRC is declaring a war against widespread irregularities, including earnings management and earnings fabrication in the stock market.

The next section briefly reviews the relevant literature on earnings management. Section 3 describes the incentives of earnings management among Chinese-listed firms and the changes to rights issue requirements in China. Sections 4–6 present our empirical results and Section 7 concludes the paper.

2. Literature review

Earnings management has been studied extensively in the literature. According to Healy and Wahlen (1999), earnings management occurs when managers use judgement in financial reporting and structure transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers. They also identify three major motivations for earnings management: (1) to benefit from favourable valuation in capital markets; (2) to fulfil contracts written in terms of accounting numbers; and (3) to meet government regulations or stock exchange requirements.

Previous authors have identified the high level of discretion that managers have to influence accounting numbers, especially through many types of discretionary accruals.[5] For example, managers can manipulate, to a certain extent, the estimates on expected lives and salvage values of fixed assets, obligations for pension benefits, deferred taxes, and losses from bad debts. They also can choose among acceptable accounting methods, such as LIFO or FIFO inventory valuation methods or the straight-line or accelerated depreciation methods, for reporting the same transactions. In addition, managers have a degree of discretion in working capital management in deciding inventory levels, timing of inventory shipments or purchases, and receivable policies. All these affect cost allocations and net revenues.

Moreover, managers can choose to make or defer expenditures, such as R&D, advertising, and maintenance. Therefore, most studies on earnings management try to measure abnormal accruals. Healy (1985), DeAngelo (1988), Jones (1991) and Dechow et al. (1995) have developed various models to estimate abnormal accruals. However, distinguishing

[4] Total net income = core income + non-core income. Non-core (or non-operating income) = investment income + income from gains + income from government subsidy + other non-operating income.

[5] See, for example, Teoh et al. (1998).

abnormal accruals from normal accruals is not an easy task. The estimate is inevitably noisy. Notably, Young (1999) finds that all these models have systematic errors in measuring abnormal accruals.

BD (1997) and DPZ (1999) adopt an alternative approach to examine earnings management. They argue that, at some thresholds, managers have strong incentives to engage in earnings management. For example, managers may want to avoid a loss or negative earnings growth, and they also may want to meet, or surpass, analysts' earnings forecasts. Both BD and DPZ examine the distribution of reported earnings around these points (thresholds). If there is no earnings management, the distribution around these points should be smooth. However, consistent with the earnings management hypothesis, they find that there is a higher-than-expected frequency of firms exhibiting slightly positive earnings (or earnings growth) and a lower-than-expected frequency of firms exhibiting slightly negative earnings (or earnings growth). Their results indicate that the distribution approach is quite effective in detecting earnings management at the relevant thresholds.

A main advantage of the distribution approach is that it can capture the effects of earnings management without estimating the noisy, abnormal accruals. This is particularly meaningful for a study of China because most firms were listed after 1994. This short history makes time-series-based accrual estimation difficult. In addition, there are many non-listed major firms in almost all industries. Since data are generally not available for non-listed firms, this makes cross-section-based (or industry-adjusted) accrual estimates troublesome as well.

The disadvantages of the distribution approach, as pointed out by Healy and Wahlen (1999), are that it captures neither the magnitude of earnings management nor the specific methods by which earnings are managed. However, we try to solve these problems in this study by using the truncated distribution to infer the distribution without earnings management and thus to estimate the pervasiveness or magnitude of earnings management. We also try to identify whether the non-core income is the major means used in earnings management by comparing the distributions between the total income and the core income.

3. Incentives for earnings management and ROE thresholds for rights issues

China's listed firms are likely to have stronger incentives than firms in other countries to conduct earnings management, especially to meet regulatory requirements to raise new equity capital in the stock market. This is largely due to China's approach to privatization. China started its economic reform in 1979 and established the stock market in the early 1990s. Almost all listed firms in China are former state-owned enterprises (SOEs). During the period of central planning, they received all the funding allocated directly from government financial reserves and turned in all their profits to the state. Beginning in the early 1980s, SOEs were required to pay taxes instead of turning in profits. On the other hand, the funding for SOE capital investments had to come through bank loans. This change, to a certain extent, relieved the government's financial burden and made SOEs more cautious in the use of capital. Unfortunately, this also led to the huge "triangular debt" problem which plagued most SOEs in the 1990s.[6] One aim in transforming SOEs into listed firms was to inject new equity capital into these companies (Mookerjee and Yu, 1999). Unlike privatization in other countries, where government sells the equity in SOEs to the public

[6] See Sun and Tong (2003).

and retains the proceeds, the Chinese government has not sold its shares. Instead, it allows companies to raise new equity in the stock market. In addition, up until 2000, China had a unique and restrictive IPO quota system (Sun et al., 2005). As a result, firms usually cannot raise enough capital through their IPOs.

Furthermore, due to the lack of effective reform in the corporate governance structure and relatively unfavourable operating conditions, the performance of many listed firms has not been improved by these reforms.[7] As a matter of fact, the overall profitability of listed firms measured by ROA and ROE has deteriorated over the period of 1994–2002. In order to sustain or expand their operations, firms have needed to raise new capital. Since the corporate debt market was virtually non-existent until recently and as bank loans restrict firms in many ways, managers prefer to raise new equity capital rather than to borrow. Since the corporate governance is poor and agency problems are serious, listed firms feel little pressure or incentive to issue cash dividends. Therefore, rights issues are the most important avenue for raising additional equity capital. In fact, most listed firms have had rights issues within three years of their listing.[8]

Managers' incentives for earnings management are enhanced by the fact that Chinese stock investors are relatively unsophisticated (Bailey, 1994) and they may not be able to see through earnings management. In addition, the auditing profession in China is not up to international standards (Aharony et al., 2000). The lack of an effective auditing system can further foster earnings management.

Repeatedly, CSRC has set and changed the standards for listed firms to issue rights, as shown in Panel A of Table 1. In 1993, firms were required to have only two consecutive years of profits before they could issue rights. In September 1994, CSRC specified, for the first time, that a firm must have an average ROE of more than 10% in the previous three years before it could issue rights. In January 1996, CSRC toughened the requirement, stating that a firm must have more than 10% ROE for each of the previous three years. CSRC then lowered the standard in March 1999, requiring that firms have an average ROE above 10% in the past three years but not lower than 6% in any of these years. In March 2001, CSRC further lowered the standard, stating that firms must have an average ROE above 6% in the past three years.[9]

As discussed previously, we believe that managers would have had a strong incentive to manipulate their earnings to address the rights issue thresholds, specifically, at the 10% level for the period 1994–1998, both at the 6% and 10% levels for the period 1999–2000, and at the 6% level for the period 2001–2002.

In Panel B of Table 1, we further present the number of rights issues across our sample years. There are altogether 770 rights issues from 1994 to 2002. According to year, 156 issues occurred in 1997, the highest during our sample period, while only 20 rights issues

[7] See Lin et al. (1998) for a discussion of four major problems faced by SOEs.

[8] Seasoned issues are allowed but were much more difficult to get approved during our sample period.

[9] The ROE requirement for seasoned issues is identical to that of rights issues. There was no formal requirement for convertible bond issues until 1997. CSRC required that a firm must have an average ROE of more than 10% in the previous three years before it could issue convertible bonds. The ROE requirement has not been changed since then. The 10% requirement is the same as that of rights issues up to the beginning of 2001. After 2001, the requirement for rights issues is 6%, which is different from the 10% requirement for convertible issues. However, the amount of convertibles issued during our sample period is very limited. In 2002, only five firms issued a total of RMB4.1 billion. This amount is already more than the total amount raised via convertible bonds in the previous 10 years.

Table 1
Rights issue requirements: This table summarizes the regulations issued by the China Securities Regulatory Commission (CSRC) regarding rights issues during the period 1994–2002

Regulation date	ROE requirement	Limit on rights issues
Panel A: rights issue requirements		
September 28, 1994	Must be profitable in each of the previous three years, and the three-year average ROE must be greater than 10%. However, for firms in the sectors of energy, raw materials and infrastructure, the average ROE can be a little lower	The total number of new shares resulting from the rights issues must be less than 30 percent of the existing tradable shares, with at least a one-year interval between the new issue and the previous equity issue
January 24, 1996	ROE must be greater than 10% in each of the previous three years. For firms in the sectors of energy, raw materials and infrastructure, the ROE should be greater than 9% in each of the previous three years	Explicitly specify that 30% of existing shares is based on existing shares excluding those issued as stock dividends
March 17, 1999	Three-year average ROE must be greater than 10%. For firms in the sectors of energy, raw materials and infrastructure, the three-year average ROE must be greater than 9%. However, in any of the previous three years, the ROE must be greater than 6%	No Change
March 15, 2001	Three-year average ROE must be greater than 6% and the expected ROE for the year of rights issue should also be greater than 6%	Thirty percent limit can be waived if the actual control shareholders buy all the new shares

	No. of listed firms	No. of firms issued rights	No. of firms eligible to issue rights	Issued as a percentage of eligible (%)
Panel B: number of rights issues across years				
1994	287	46	n.a.	n.a.
1995	311	68	n.a.	n.a.
1996	513	48	75	64.0
1997	720	156	166	94.0
1998	826	125	240	52.1
1999	924	116	185	62.7
2000	1060	108	148	73.0
2001	1136	83	228	36.4
2002	1199	20	153	13.1

It also presents the rights issue statistics for the same period.

occurred in 2002, the lowest in the sample period. The number of firms that issued rights as a percentage of firms that met the CSRC requirement for rights issues during the period 1996–2000 ranges from 13.1% in 2002 to 94% in 1997.

4. Earnings management at thresholds

Following BD (1997) and DPZ (1999), we assume that the cross-sectional distribution of ROE is relatively smooth in the absence of earnings management. However, if managers engage in earnings management in response to the ROE thresholds, such as the minimum 10% requirement set by CSRC for rights issuing, distributions of reported ROE will

get distorted: unusually low frequencies of firms will fall just below the threshold and unusually high frequencies of firms, just above it.

To examine if any earnings management exists at the ROE thresholds, as specified in the previous section, we collect annual ROE data across all listed firms (either on SHSE or SZSE) over the period 1994–2002 from the CSMAR database and company financial reports. To distinguish our study from the IPO earnings management, we exclude the ROE data in the listing year.[10] We also exclude firms with missing data. Our final samples consist of 5921 observations.[11] A weakness of this dataset is its relatively small sample size which may make our inference less convincing relative to that shown in Burgstahler and Dichev (1997) and Degeorge et al. (1999).[12] However, the small sample size may also make our results more impressive because there has to be a strong effect for patterns to emerge to the level of statistical significance.[13]

Since the ROE requirements for rights issues were changed in March 1999 and again in March 2001, we divide the whole sample into three sub-samples in our study: 1975 observations for the period 1994–1998, 1748 for the period 1999–2000, and 2198 for the period 2001–2002.[14] The three sub-samples are plotted in Panels A–C of Fig. 1, respectively. The horizontal axis indicates ROE, while the vertical axis indicates the number of firms corresponding to each ROE percentage interval. It is obvious that there are some outliers. However, we do not exclude them because our focus is on the distribution around the 6% and 10% ROE thresholds, which is not affected by the outliers.

A casual observation shows that the non-smoothness occurs at the relevant thresholds. In Panel A, we see that the frequencies are unusually high just above 10% and zero, but unusually low just below these two points. The non-smoothness at 10% is consistent with our hypothesis that firms engage in earnings management at this threshold to ensure rights

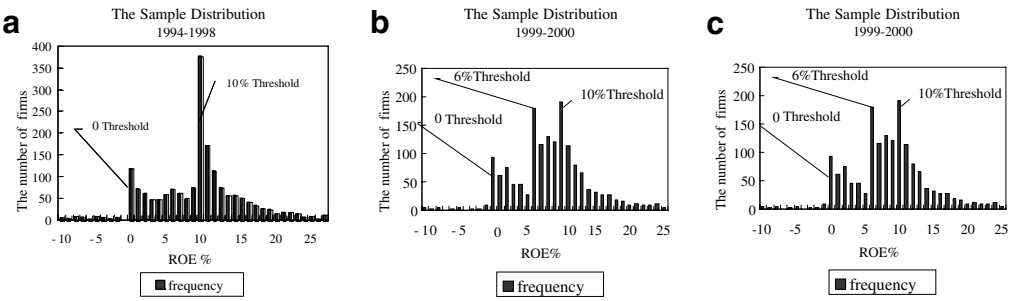

Fig. 1. Sample distributions: This figure shows the distribution of 1975 observations for the period 1994–1998, 1748 observations for the period 1999–2000, and 2198 observations for the period 2001–2002, respectively. The vertical axis indicates the number of firms or frequency, while the horizontal axis indicates the return on equity (ROE) in percent.

[10] Teoh et al. (1998) and DuCharme et al. (2001) have documented that firms heavily engaged in earnings management in the year of IPO.

[11] Excluding a few firms with a lower ROE requirement for rights issues in the sectors of energy, raw materials and infrastructure during the period 1996–2000 does not generate qualitatively different results.

[12] Burgstahler and Dichev (1997) and Degeorge et al. (1999) samples consist of 70,000 and 100,000 observations, respectively.

[13] Our test statistics at the relevant thresholds as shown in Table 2 are all significant at 5% or better.

[14] The small sample size makes it impossible to apply our testing method on a yearly basis.

issues during the period 1994–1998, while non-smoothness at zero is within the expectation because it is also a threshold for firms. Previous studies have provided consistent evidence that managers have the incentive to engage in earnings management in order to report positive earnings (see BD and DPZ). However, the zero threshold is not our focus.

In Panel B, we see that there is non-smoothness at the 10% and 6% levels. This is consistent with the changed ROE requirement for rights issues in 1999, which still required that the three-year average ROE before rights issues should be higher than 10%, but the ROE could be as low as 6% in one or two of the three years. In Panel C, we see that non-smoothness occurs at the 6% level. This, again, is consistent with the further change in the ROE requirement to the three-year average above 6% in 2001.

We also develop a *t*-statistic (see Appendix) to test the statistical significance of the smoothness for 17 different percentage points in the ROE distribution, namely, ROE = 2, 3,...18%. As shown in Table 2, for the period 1994–1998, our *t*-test statistics reject the null hypothesis that the distribution is smooth at ROE = 10–12%. Notice that all these points are close to the 10% threshold for this period. This indicates that Chinese-listed firms engaged in earnings management to meet the 10% requirement for rights issues during 1994–1998.

The test for the period 1999–2000 is capable of capturing the change in ROE requirements for rights issues in 1999. The *t*-statistics reject smoothness of the ROE distribution at 6%, 8%, 9%, 10%, 11%, and 12%.

The significant *t*-statistic at ROE = 6% is consistent with the new 6 percent threshold resulting from the change in regulating rights issues in 1999. Although the 1999 regulation still requires the three-year average ROE to be greater than 10%, the economic situation was not good, due to the Asian economic crisis. Therefore, many firms may only have had the capability to manage earnings to meet the minimum requirement of 6% specified in the 1999 regulation change. This also can explain why the smoothness hypothesis was rejected

Table 2
Test results on smoothness of the ROE distribution: This table presents the *t*-test statistics on smoothness of the ROE distribution at various points

ROE (%)	1994–1998	1999–2000	2001–2002
2	−0.943	−0.461	−10.759**
3	−0.306	1.867	−1.566
4	1.650	−0.623	−1.934
5	−1.780	1.993	1.989
6	0.985	−5.505	−7.097**
7	1.275	−1.085	3.530**
8	1.413	−10.570**	2.379**
9	−0.081	4.597**	−5.475**
10	−5.623**	−7.134**	−1.967
11	3.012**	5.277**	1.436
12	2.263**	3.328**	−0.849
13	1.340	0.914	3.496**
14	0.936	1.851	1.859
15	−1.758	−1.957	−1.820
16	0.080	1.736	1.966
17	−0.968	−0.363	−1.507
18	0.288	1.952	1.845

** Denotes significance at the 5% level.

at ROE = 8%, 9%, 10%, 11% and 12%, because the three-year average ROE greater than 10% was still required until early 2001.

Similarly, the results for the period 2001–2002 show that our method is able to capture the change in ROE requirements for rights issues in 2001. Consistent with the requirement change, the *t*-statistics reject smoothness of the ROE distribution at 6%, 7%, 8%, 9% and 13%. The significant *t*-statistics at ROE = 6%, 7%, 8%, and 9% are consistent with the 6% threshold. However, the significant *t*-statistic at 13% is not consistent with any identifiable threshold.[15]

Overall, the results reported in Table 2 confirm the observations presented in Fig. 1 that listed firms in China engaged in earnings management at the 6% and/or 10% ROE thresholds to meet the requirements for rights issues.

5. The pervasiveness of earnings management at the thresholds

In addition to examining whether there is any earnings management at the threshold, we also analyze the pervasiveness of the earnings management. The pervasiveness refers to the percentage of firms in a sub-sample at or around the threshold that engages in earnings management. In order to measure the pervasiveness of the earnings management, we need to compare the observed number of firms at some small interval just above (and below) the threshold in the presence of earnings management with the expected number of firms at the same interval in the absence of earnings management. Therefore, the key is to find the ROE distribution in the absence of earnings management.

Since all listed firms face the same macroeconomic and regulatory environment, the ROE variability among firms is mainly determined by firm-specific factors. We, therefore, assume that, in the absence of earnings management, ROE is normally distributed, i.e., $\mathrm{ROE} \sim \mathrm{N}[\mu, \sigma^2]$. If there is neither motive nor evidence for earnings management beyond a certain point of the actual ROE distribution, we can just truncate the distribution at that point and assume that the truncated part (the distribution right to the truncation point) is normally distributed. Then, we can further infer the mean and variance of the whole ROE distribution in the absence of earnings management from the truncated distribution (see Greene, 1990), and thus, restore the whole distribution.

As mentioned before, the CSRC requires a firm to have a greater than 10% ROE for the past three years before it can raise new capital via rights issues. It is not too unreasonable to expect that beyond a certain point, $\mathrm{ROE} > b$, where b is a point reasonably greater than the 10% threshold, managers have no incentive to engage in earnings management. This is because the management compensation scheme described in Healy (1985) did not exist in China during our sample period, and thus, managers did not have the incentive to maximize their overall compensation by under-reporting the current year's earnings. Even if they did, there is no reason to assume such earnings management would be concentrated at any particular threshold.

A truncated normal distribution is a part of a non-truncated normal distribution. From the former, we can infer the latter. The expectation of the truncated distribution (the part with no earnings management) is

$$\mathrm{E}(\mathrm{ROE}|\mathrm{ROE} > b) = \mu + \sigma\phi(\alpha)/\{1 - \Phi(\alpha)\}, \tag{1}$$

[15] We also apply the BD and DPZ methods and both reject smoothness at ROE = 13%, also.

where

$$\alpha = (b - \mu)/\sigma, \tag{2}$$

$\Phi(\alpha)$ is the standard normal accumulative distribution function or the degree of truncation, namely, the probability of ROE $< b$. As b increases, this probability increases, and a larger part of the distribution is abandoned. $\phi(\alpha)$ is the standard normal probability density function. Once the b is determined, we can derive $\phi(\alpha)$, $\Phi(\alpha)$ and $\alpha\,(=\Phi^{-1}(\alpha))$. Then, we can further solve the system of Eqs. (1) and (2) for μ and σ, the mean and standard deviation of the restored ROE distribution with no earnings management.

Thus, the above method can help us compute the pervasiveness of earnings management. By comparing the observed ROE distribution and the expected ROE distribution with no earnings management, we can obtain the number of firms engaging in earnings management as a percentage of the firms that should fall just below or above the threshold in the absence of earnings management. Although rough, this can provide some indication of the pervasiveness of earnings management.

We see in Table 2 that from ROE = 15% onwards, the smoothness of the distribution cannot be rejected for the 1994–1998, 1999–2000 and 2001–2002 samples. Since truncating the distribution at different points may lead to different restored normal distributions, we compute three restored distributions based on truncating points at 16%, 17% and 18%, respectively, and choose the one with the best fit to the actual distribution. The best fit ROE distribution versus the actual ROE distribution for the 1994–1998, 1999–2000, and 2001–2002 periods are plotted in Fig. 2(a)–(c), respectively.

Fig. 2(a) clearly shows that the frequencies in the actual distribution are significantly higher than the expected ones at the intervals 10–11%, 11–12% and 12–13%, but lower at the intervals between 2% and 10% and the intervals below zero. This is generally consistent with our previous findings that firms with ROE lower than the thresholds engage in earnings management to boost the ROE above the thresholds.

Fig. 2(b) also shows that the frequencies in the actual distribution are higher than the expected distribution above the 6% threshold, but lower below the threshold. However, the frequencies of the actual distribution are higher than the expected distribution from 6% until 13%, although the frequency at the 10–11% interval is the highest within this range. This is interesting because we would anticipate that the actual frequency below

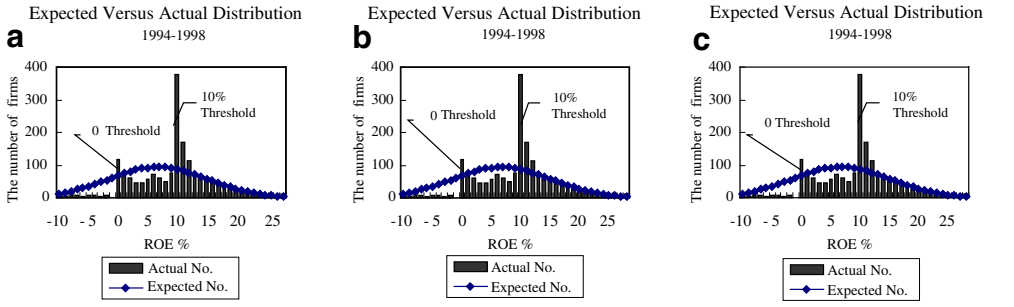

Fig. 2. Expected versus actual distribution: This figure shows the actual distribution of observations versus the expected distribution inferred from the truncated distribution for the periods 1994–1998 (1975 observations), 1999–2000 (1748 observations), and 2001–2002 (2198 observations), respectively. The vertical axis indicates the number of firms, or frequency, while the horizontal axis indicates the return on equity (ROE) in percent.

the 10% threshold should be lower than the expected one. One possible explanation is that our restored normal distribution may not be a good representation of the true distribution in the absence of earnings management.

However, we have a more plausible explanation. The three-year average ROE requirement for rights issues was in transition during this period, from 10% to 6%. The higher than expected frequency of the ROE distribution from 7% to 9% may have resulted from a mixing of earnings management to meet the two different thresholds, ROE = 6% and 10% during 1999–2000. As mentioned earlier, although a three-year average greater than 10% was still required in 1999 and 2000, the adverse impact of the Asian economic crisis, and the severe deflation experienced in China during those years, made it impossible for many firms to manage their earnings to reach the 10% threshold. Instead, these firms turned to managed earnings to meet the minimum requirement: ROE greater than 6%. However, some firms were still able to manage their earnings to be greater than the 10% level.[16]

Fig. 2(c) shows that the frequencies in the actual distribution are higher than the expected distribution above the 6% threshold, but lower below the threshold. Consistent with the 6% ROE requirement during the period 2001–2002, there is no spike around ROE = 10%.

From the differences between the actual and expected ROE distributions, we compute the percentage of firms engaged in earnings management to be near the 10% and 6% thresholds. Table 3 presents the results for the 1994–1998, 1999–2000, and 2001–2002 periods in Panels A–C, respectively.

From Panel A, we see that the expected number of firms falling in the 10–11% interval should be 87, but the actual number of firms in the interval is 377. This suggests that an excess of 290 firms managed to report their ROE in this interval, which is 333% of the expected number of firms or 14.7% of the whole distribution during the period 1994–1998. Earnings management is very pervasive at this threshold! The number of firms engaged in earnings management is 109% for the 11–12% interval, which is also quite high. Yet the negative sign for the intervals below the threshold indicates that the actual number of firms in these intervals is lower than expected. The shortage is 35%, 48%, and 17% for ROE intervals of 7–8%, 8–9% and 9–10%, respectively. A similar pattern can be observed around the 10% and 6% thresholds in Panel B and the 6% threshold in Panel C. In 1999–2000, 205% and 117% of the expected number of firms at the interval 10–11% and 6–7%, respectively (or 7.4% and 5.5% of the whole distribution) engage in earnings management. Furthermore, 96% of the expected number of firms (or 6.3% of the whole distribution) engage in earnings management at the 6–7% interval in 2001–2002.

Since our assumption of a normal distribution may be too simplistic to capture the reality, these estimates on pervasiveness may not be very accurate. Particularly, very few observations appear for ROE < 0. As an alternative, we further truncate the restored distribution at ROE = 0 and use that as the benchmark distribution without earnings man-

[16] We have also examined the data for individual years from 1999 to 2002. We find that the 10% threshold is a bit more obvious for 1999 data, while the 6% threshold dominates from 2001. However, for 2000 data, both 6% and 10% seem to be thresholds. This is consistent with the rights issue requirement change during this period. Since the sample size is small for individual years, it makes the restoration of the normal distribution less reliable. Therefore, we do not want to make strong inferences from these findings. The results are not reported to save space, but are available upon request.

Table 3
The pervasiveness of earnings management around the 10% or 6% ROE threshold: This table presents the estimated frequency of the firms that engage in earnings management just around the 10% and 6% ROE thresholds

ROE (%)	Expected no. of firms	Actual no. of firms	No. of firms engaged in EM	% of firms engaged in EM (%)
Panel A: 1994–1998				
2–3	80	61	−19	(24)
3–4	85	46	−39	(46)
4–5	89	47	−42	(47)
5–6	92	58	−34	(37)
6–7	93	71	−22	(24)
7–8	94	61	−33	(35)
8–9	93	48	−45	(48)
9–10	90	75	−15	(17)
10–11	87	377	290	333
11–12	82	171	89	109
12–13	77	113	36	47
13–14	71	75	4	6
Panel B: 1999–2000				
2–3	86	75	−11	(13)
3–4	87	46	−41	(47)
4–5	87	45	−42	(48)
5–6	86	28	−58	(67)
6–7	83	180	97	117
7–8	79	116	37	47
8–9	74	129	55	74
9–10	69	120	51	74
10–11	63	192	129	205
11–12	56	113	57	102
12–13	50	79	29	58
13–14	43	65	22	51
Panel C: 2001–2002				
2–3	137	130	−7	(5)
3–4	145	145	0	0
4–5	149	133	−16	(11)
5–6	149	129	−20	(13)
6–7	144	282	138	96
7–8	136	173	37	27
8–9	125	134	9	7
9–10	111	112	1	1
10–11	96	103	7	7
11–12	80	76	−4	(5)
12–13	65	69	4	6
13–14	52	31	−21	(40)

The expected number of firms with no EM is based on the distribution inferred from the truncated distribution, which is assumed normal. The number of firms engaged in EM in a particular interval is the difference between the actual number of firms and the expected number of firms in the interval. The percentage of the firms engage in EM is derived by dividing the difference between the actual and the expected number of firms by the expected number of the firms in the interval.

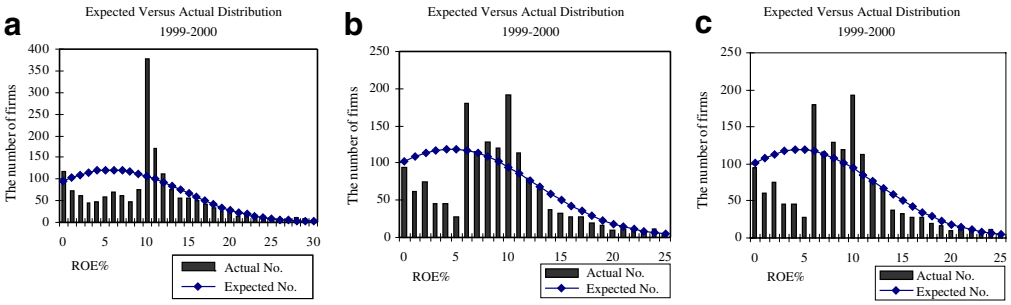

Fig. 3. Expected versus actual distribution: This figure shows the actual distribution of observations versus the expected distribution inferred from the truncated distribution for the periods 1994–1998 (1975 observations), 1999–2000 (1748 observations), and 2001–2002 (2198 observations), respectively. The expected distribution is truncated at zero. The vertical axis indicates the number of firms, or frequency, while the horizontal axis indicates the return on equity (ROE) in percent.

agement. Then, we re-compute the pervasiveness of earnings management around various thresholds. Fig. 3 presents the graphical distributions of expected and actual ROE for the three sample periods.

In general, the pattern is similar to those presented in Fig. 2. However, the pervasiveness of earnings management at the relevant thresholds is less severe. This is within the expectation because the truncation at ROE = 0 shifts up the distribution curve.[17] The pervasiveness of earnings management derived from such a truncated curve is more conservative than the previous restored normal distribution curve. We re-compute the percentage of firms engaged in earnings management near the 10% and 6% thresholds as presented in Table 3 for the three sample periods. For the period of 1994–1998, the percentages of firms engaged in earnings management in the intervals 10–11% and 11–12% are 234% and 60%, respectively, are much lower than the corresponding percentages, 333% and 109%, in Panel A of Table 3. For the periods 1999–2000 and 2001–2002, 59% and 57% of firms engage in earnings management at the interval, 6–7%, respectively, and the corresponding percentages for the same periods reported in Table 3 are 117% and 96%. To save space, we do not report all the results here.

Although our estimation may not be very accurate, we do believe these estimates provide some useful indications of the possible range of the pervasiveness of earnings management among Chinese-listed firms.

6. Non-core income as a means for earnings management

One shortcoming associated with the distribution approach is that it cannot tell us which accounting items are used in earnings management (Healy and Wahlen, 1999). However, Chen and Yuan (2004) document that earnings management in China is mainly reflected in non-core income. Therefore, as a simple check, we further plot the distribution of the normal ROE versus the distribution of the core ROE. If the non-core ROE is the major means used in earnings management, then the distribution of the core ROE, which

[17] The area under the truncated curves should still be equal to 1.

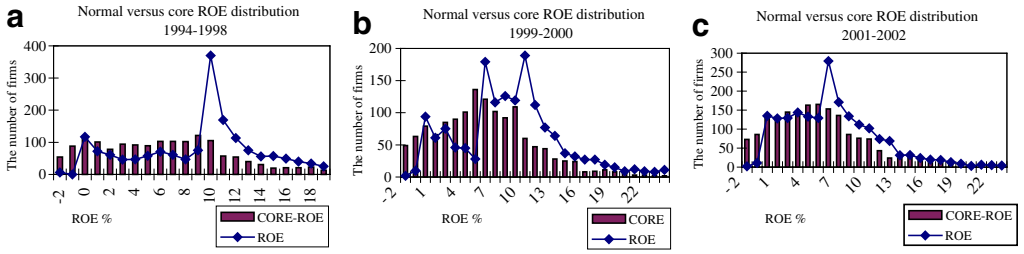

Fig. 4. Sample distributions: This figure shows the distribution of the normal ROE (total net income divided by the total equity) versus the distribution of the core ROE (core net income divided by the total equity) for the periods 1994–1998 (1975 observations), 1999–2000 (1748 observations), and 2001–2002 (2198 observations), respectively. The vertical axis indicates the number of firms, or frequency, while the horizontal axis indicates the core and normal (ROE) in percent.

is equal to the normal ROE minus the non-core ROE, should not exhibit big spikes at the thresholds.[18]

Fig. 4 shows the normal versus the core ROE distribution for the three sample periods in Panels A–C, respectively. It is very striking that the core ROE distribution is much smoother than the normal ROE distribution. As shown in Panels A and C, the spikes at the 10% and 6% percent thresholds for the periods 1994–1998 and 2001–2002 disappear totally. The spikes at both the 10% and 6% thresholds shown in Panel B are much smaller than those shown for the normal ROE distribution. These plots in Fig. 4 are consistent with the findings of Chen and Yuan (2004) and lend further support to the view that the non-core income in China directly reflects the extent of earnings management.

7. Conclusion

China's listed firms were required to exceed thresholds of 6% and 10% ROE before they were allowed to have rights issues for the period 1994–2002. We show that earnings management at these thresholds was very pervasive and that non-core income was the major means used in such earnings management. These findings have policy implications for CSRC and general implications for investors.

Our statistical methods employ a distribution approach that is both simple and intuitive, and can be broadly applied, e.g., in examining responses to any grading or regulatory system.

Appendix. Test Statistics

As a modification of BD and DPZ, we define that an ROE distribution at a point is smooth if, and only if, the first order derivative of the probability density function exists at that point. Mathematically, this means that the left derivative should be equal to the right derivative at the point. Let x and $f(x)$ be the variable of interest, such as ROE, and the probability density function of ROE, respectively. Given a random sample of x of size N, we estimate the density for discretely ordered and equispaced points: x_0,

[18] We thank a referee for suggesting this to us. Please see footnote 2 for the definition of non-core ROE.

$x_1, \ldots, x_n$, etc. We compute the proportion of the observations that lie in bins covering $[x_0, x_1)$, $[x_1, x_2)$, $\ldots, [x_n, x_{n+1})$, and so on. These proportions, denoted $p(x)$, provide estimates of $f(x)$ at $x_0, x_1, \ldots, x_n$, etc. Applying the Taylor expansion at x_0, the threshold, re-arranging terms, and lumping together higher order terms into the residual, ε, we can obtain the following equations for regressions:

$$\{p(x_0 + \Delta x) - p(x_0)\}/\Delta x = \alpha_{-0} + \beta_{-0}\Delta x + \varepsilon(\Delta x \to x_0 \text{ from left}), \tag{A1}$$

$$\{p(x_0 + \Delta x) - p(x_0)\}/\Delta x = \alpha_{+0} + \beta_{+0}\Delta x + \varepsilon(\Delta x \to x_0 \text{ from right}), \tag{A2}$$

where $\Delta x = x - x_0$. Since $p(x)$, the estimate of $f(x)$, is not really continuous, we may not be able to get the limit when Δx goes to zero. Operationally, therefore, Δx must be a multiple of the equispaced interval (or bin). Corresponding to each Δx, we compute $\{p(x_0 + \Delta x) - p(x_0)\}/\Delta x$. As Δx tends to zero, the intercepts α_{-0} and α_{+0}, can be used to proxy the left and right derivatives, respectively. If the distribution is smooth at x_0, the right derivative should be equal to the left derivative, which implies that the difference between the two intercepts should not be statistically different from zero. The t-statistic is constructed by using the regression intercepts and their corresponding standard errors:

$$t = \frac{\alpha_{-0} - \alpha_{+0}}{\sqrt{s^2_{\alpha_{+0}} + s^2_{\alpha_{-0}}}}, \tag{A3}$$

where $s_{\alpha+0}$ and $s_{\alpha-0}$ are the standard errors of α_{+0} and α_{-0}, respectively, and can be directly obtained from regressions of Eqs. (A1) and (A2).

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